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Recycle and Disposal Options for CFC's and Halons

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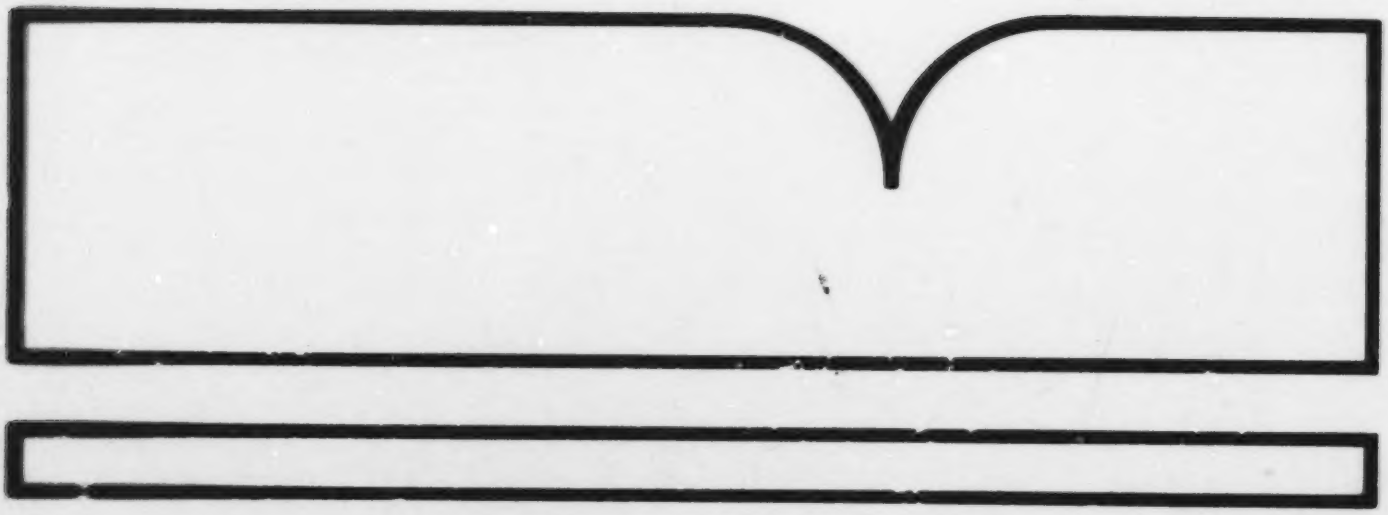

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16. ABSTRACT

The paper discusses recycle and disposal options for chlorofluorocarbons (CFCs) and halons. These options will become more important as supplies become limited in compliance with the Montreal Protocol, particularly if these chemicals are completely phased out by the year 2000, as called for by about 80 nations at the May 1989 Helsinki meeting. Even with new replacement chemicals, recycling will be important because of the higher cost and global warming that would result from release of the replacements. Options for the recovery, recycle, reclamation, and disposal of CFCs and halons need to be understood so that the most environmentally, technically, and economically effective systems can be selected. The options for recovery, recycle, reclamation, and disposal of CFCs and halons are reviewed briefly in the paper. A partial list of manufacturers of recovery/recycle equipment and those doing on- and off-site recovery/recycle/reclamation or planning to start this service in the near future is included.

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Recycle and Disposal Options for CFCs and Halons

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INTRODUCTION

Recycling and disposal of chlorofluorocarbons (CFCs) and halons will become more important as supplies become limited in compliance with the Montreal Protocol, particularly if a complete phaseout of these chemicals is required by the year 2000 as called for by approximately 80 nations at the May 1989 Helsinki meeting. Even with new replacement chemicals, recycling will be important because of the higher cost and the global warming that would result from release of the replacements. The options for the recovery, recycle, reclamation, and disposal of CFCs and halons need to be understood so that the most environmentally, technically, and economically effective systems can be selected. The options for recovery, recycle, reclamation, and disposal of CFCs and halons are reviewed briefly in this paper. A partial list of companies manufacturing recovery/recycle equipment and those doing on- and off-site recovery/recycle/reclamation or planning to start this service in the near future is included.

HISTORY OF RECYCLING AND DISPOSAL

Recycling of CFCs has overcome skepticism and become more commercial. In 1981, Edward H. Lightcap of DuPont's Freon Products Division told the annual American Refrigeration Institute (ARI) meeting that reclaiming was viable only for Original Equipment Manufacturers (OEMs) but should not be considered for service operations.[1] He emphasized the danger in the reuse of impure refrigerant and the safety hazards associated with the collection procedures. Lightcap reported that only two recovery systems were available for OEM use (designed originally by DuPont and custom-built by Serv-I-Quip at costs of $20,000 and $30,000), and only one system for on-site recovery. The on-site system was being built by Draf Industries, Inc. and was being tested by two automobile manufacturers in their dealerships.

In 1981, only one company, Omega Chemical Co. of Whittier, CA, would recycle refrigerant in bulk by reprocessing. Now in 1990 a dozen companies manufacture portable equipment for automobile servicing; Carrier and Trane sell recycle equipment for large CFC-11 chillers, and several off-site facilities are in operation.

The industry grew up slowly but carefully. Applied Ecological Systems developed their first portable recovery/recycle unit in 1968. This unit was marketed for residential, commercial, industrial, automotive, and transportation applications. Prior to the recent restriction on the supply of CFCs, the small portable recovery/recycle devices found application mainly in large public transportation or trucking firms where they were more easily economically justified. Refrigerant Recovery Systems, Inc. has marketed CFC recovery/recycle systems since the early 1980s and as early as 1986 had their systems in use in more than 20 municipal transit and large trucking garages. A'Gramkow has manufactured a wide range of portable and fixed recovery/recycle devices in Europe since 1978. Their first unit for use in the automotive industry was sold to Volvo about 1985 for use on an assembly line. Major manufacturers of refrigeration units for refrigerated trucks have been offering refrigerant recovery/recycle units for several years. Carrier Transicold reports that about 75 percent of its dealers are currently using and selling the systems. Thermo King reports that nearly half of their dealers have the systems in operation.

The Montreal Protocol allows countries to increase production by the volume of CFC or halon destroyed, providing that the destruction technology had been approved by the Parties to the Protocol.[2] The Parties have not yet approved possible destruction technologies and accounting mechanisms. A report was published in October 1989 by EPA as the first step in the United States' review of such technologies.[3] This report will serve as the basis for additional work in this area. Thermal incineration was found to be the only technology currently available at commercial scale for destruction of CFCs and halons. Examples of dedicated CFC incinerators were found, as well as general hazardous waste incinerators that can co-fire CFCs with other wastes. The dedicated CFC incinerators were found only at CFC manufacturing facilities (e. g., DuPont and Pennwalt in the U.S., ICI in Great Britain, and Hoechst A. G. in West Germany). The co-fired incinerators were found at commercial hazardous waste disposal facilities (e. g., Rollins, GSX, LWD, and Chemical Waste Management). The co-fired incinerators are limited by permit as to how much CFC they can feed, with limits ranging from a maximum of 5 percent to as little as 100 parts per million.

OPTIONS FOR CFC RECOVERY

In January 1989, EPA and the major automobile manufacturers joined together in a press conference at the Mobile Air Conditioning Society (MACS) to announce a voluntary agreement on an industry standard of purity for recycled refrigerant from automobile air conditioners. This standard was developed over a period of 12 months by a joint committee of industry and EPA representatives. The committee included representatives from the Motor Vehicle Manufacturers Association of the United States (MVMA); the Automotive Importers of America, Inc. (AIA), which includes leading importers; the Mobile Air Conditioning Society (MACS); the Society of Automotive Engineers (SAE); the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE); manufacturers of small recovery/reclamation/recycle devices; small air conditioning service shops; and other automotive industry representatives and individuals.

At the request of this committee, EPA's Air and Energy Engineering Research Laboratory (AEERL) at Research Triangle Park, NC, conducted an engineering study to test the quality of refrigerant in automotive air conditioners in 227 different makes and models, in different geographical regions, and under various driving and weather conditions.[4,5] This study concluded that for automobile air conditioners the refrigerant does not degrade significantly with use. The standard of purity for recycled refrigerant accepted by the automobile industry was based on results of this study. The standard has been published by SAE as SAE-J1991 (1989).[6]

The nature of the automobile air conditioning industry—many small shops scattered over a wide area—made it desirable to use small portable recovery/recycle devices on site for recovery and recycle of the refrigerant. Underwriters Laboratories is in the process of certifying the recycle equipment to meet SAE-J1991, the standard of purity established by the committee.[7] Six devices have been certified to date. An active campaign is underway by MACS and EPA to encourage the use of recycle equipment by the automobile industry. Most of the major automobile manufacturers have committed to require dealers and factories to purchase and use recycling

systems during manufacture and servicing of automobile air conditioners by the fall of 1990.

AEERL has initiated a project to expand applicability of recovery and recycling techniques to all other refrigeration and air conditioning applications. In fact, the Alliance for Responsible CFC Policy has petitioned the Agency to establish national requirements for all refrigerants. A joint effort of all interested parties can develop practical standards and functional descriptions for recycle equipment and realistic certification test methods. A successful program will contribute to protecting the environment and ensuring a supply of refrigerant for servicing of existing refrigeration equipment as the availability of refrigerant is restricted. The project will assist EPA and industry in understanding the issues involved, the servicing purposes and practices, the history of contamination, causes of the contamination, field and laboratory techniques to evaluate contamination, and the types of commercial recycling efforts needed (on-site, regional, remanufacture).

This will require that sampling and analysis procedures be developed to establish the level and type of contaminants in refrigeration systems. The sampling methods used during the automobile air conditioning study can be improved even further.[4] It is anticipated that the refrigerant systems with hermetic compressors will be more severely contaminated than automotive air conditioners due to contamination from motor burnout. The test program will be designed to determine the average and worst case contamination from each refrigeration application in order to determine the level of cleanup that will be required.

Recycle equipment used for various refrigeration applications will vary greatly in design and size and can be classified as:

1. In-System

   In some cases of lightly contaminated refrigerant, cleanup can be accomplished by circulating the refrigerant through a liquid line filter-drier. This procedure is described in the ASHRAE Handbook.[8]

2. Small Portable Units

   There are many manufacturers producing or developing small portable recycle devices currently. These small portable recovery/recycle devices remove and temporarily store the refrigerant; filter to remove acid, moisture, and particulates; and purify through simple vaporization and condensation. A means to detect and purge excess amounts of noncondensable gases may be provided.[9] The market for these systems has been concentrated on the automotive air conditioner industry, but most of the manufacturers also make one or more units for commercial applications. These units generally process 1 to 4 lb/min (0.45 to 1.8 kg/min) of refrigerant and are small enough that they can be taken to a roof top for recovery and recycle of refrigerant on-site.

3. Larger Skid Mounted or Truck Mounted Units

If the small portable units are too small, on-site recovery and recycle can be accomplished by a skid mounted or a truck mounted unit. These systems are moved as close to the source as practical and connected to the refrigeration system with hoses. Currently at least one company is doing field recovery and recycle of refrigerant from chillers using a skid mounted unit. Another company advertises that they can provide a trailer mounted unit capable of processing 500 to 2000 lb (230 to 900 kg) of refrigerant.

4. Local and Regional Recovery Facilities

Where it is not practical to do recycling on-site, a local or regional recycling facility can be used. For example, Whirlpool Corp. plans to capture the refrigerant in a plastic bag during service of a domestic refrigerator. The bag is taken to a recovery center where the refrigerant is transferred to a pressurized tank and held for recycling. The recycling device at a local recycle facility can vary from a small recovery device up to a large permanent installation. Appliance Recyclers of America, Inc. has been recovering refrigerant from used domestic refrigerators for about a year at central locations where used refrigerators are received. They recover and recycle the refrigerant using a small recovery/recycle device similar to those used for automotive air conditioner refrigerant recovery.

5. Manufacturing or Feedstock Facilities

Where large amounts of refrigerant must be recycled or the refrigerant must be cleaned to meet new refrigerant specifications, the best choice may be a regional recycling facility or a manufacturing or feedstock facility. Distillation is used as the means of purification in these facilities.[9] Omega of California has processed refrigerant in their regional facility to meet new refrigeration specifications for more than 30 years. They are currently planning to build a similar facility on the east coast. At least two other companies plan or have under construction large scale regional recovery facilities in the eastern half of the Country. The large chemical producers of refrigerants also are doing some recycling, and several of them plan to start large scale recycling of refrigerant in their manufacturing and feedstock facilities in the near future.

Some guidance is needed to help develop procedures for determining the extent of cleanup required and the type of recycle systems that can be used. A simple field test is needed that will determine the level of cleanup needed which could be:

A. No cleanup required

B. Cleanup without removal from the refrigeration system

C. Removal of the refrigerant and return after refrigeration equipment servicing without cleanup of the refrigerant

D. Removal of the refrigerant, flushing the refrigeration system, and returning refrigerant after on- or off-site reclamation

The extent of contamination will determine the level of cleanup required and, along with consideration of the size of the refrigeration process, the type of recovery system that can be used.

OPTIONS FOR CFC DESTRUCTION

As stated earlier, thermal incineration is the only technology which was found to be commercially available for destruction of CFCs. There are environmental concerns surrounding thermal destruction of CFCs and halons that need to be resolved. These include possible formation of potentially hazardous products of incomplete combustion (PIC) and corrosive acid and/or halogenated gas emissions. Although the acid gases can be scrubbed, the scrubber by-products create the need for disposal and handling.

Other technologies have been proposed for CFC destruction.[3] Catalytic incineration is similar to thermal incineration, but the destruction is achieved at lower temperatures by the use of a catalyst. Pyrolysis is destruction at high temperatures, but without excess oxygen for direct combustion. Active metals scrubbing uses sodium, zinc, or aluminum metal to rapidly react with halogenated compounds. Chemical scrubbing uses a highly alkaline reagent to destroy halogenated compounds. Wet air oxidation uses a moderate temperature aqueous stream with oxygen to destroy organic compounds. Supercritical water oxidation is similar to wet oxidation, but it operates at higher temperatures and pressures. Corona discharge uses energized electrons from an ionized corona field to destroy many organics. All of these technologies are considered to have some potential for destroying CFCs. Some of them have been used commercially for destruction of other types of wastes, but they have not been used for CFCs or halons.

CURRENT RECYCLING AND RECLAMATION EQUIPMENT AND FACILITIES

An increasingly large number of companies are manufacturing recovery/recycle devices or are developing reclamation facilities. An attempt has been made to identify as many of these companies as possible. However, omissions are not intentional but would further show the need for a publicized list. Information was obtained from sales literature and from discussions with the companies involved. The companies identified are listed in the appendix in two major categories, off- and on-site recovery/reclamation.

NATIONAL, STATE, AND LOCAL RECYCLE REGULATIONS

In August 1988, under authority of the Clean Air Act, EPA issued regulations limiting the production and consumption of CFCs to the 1986 level starting July 1, 1989.[10] The production and consumption must be reduced 20 percent from the 1986 level starting July 1, 1993, and an additional 30 percent starting July 1, 1998. In an Advanced Notice of Proposed Rulemaking (ANPRM) issued in August 1988[11] EPA stated its intent to develop mandatory regulations requiring recycling in all automobile air conditioning service

shops by 1992 if near-term progress toward the use of recycling in this segment did not occur.

Connecticut, Hawaii, Illinois, Oregon, and Vermont have recently adopted laws that require recycling in such use sectors as automobile air conditioning, building chillers, and refrigeration. At least seven other states (California, Colorado, Maryland, Massachusetts, Minnesota, New York, and Wisconsin) have proposed regulation. EPA has received a petition from the Alliance for Responsible CFC Policy requesting promulgation of regulations that address the recycling of fully halogenated CFCs. The Alliance is the trade organization that represents the companies involved in the manufacture, importation, distribution, sale, and use of CFCs, and whose stated purpose is to pursue "soundly based policies and regulations respecting potential depletion of the stratospheric ozone layer."

The Alliance asked EPA to develop and implement uniform federal standards that require recycling of CFCs contained in and released from air conditioning and refrigeration systems. The Alliance said that recycling was warranted by the need to protect the ozone layer and to minimize the "adverse societal impacts" of the transition to the alternative chemicals and products. The Alliance expressed concern that recent state actions requiring recycling could create differing state standards, leading to an ineffective system at the national level to capture, reclaim, and reuse ozone depleting chemicals. For these reasons, the Alliance requested EPA to promulgate national regulations on recycling that would preempt these and future state actions. In response to this petition, EPA is developing an ANPRM to investigate the need for a National Recycling Program for CFC and halon using industries. The goal of a National Recycling Program would be to reduce or eliminate unnecessary emissions of ozone depleting substances normally vented into the atmosphere from CFC- or halon-using equipment. The ANPRM will present issues, questions, and ideas associated with a National Recycling Program and will request comments from all interested parties on all aspects of such a program.

There has been much uncertainty of the regulated community over the classification of used CFCs as hazardous waste under the Resource Conservation and Recovery Act (RCRA). EPA clarified this in a July 1989 Federal Register notice.[12] The notice states that used CFCs are not a hazardous waste under normal operating conditions. There is no requirement to test refrigerant prior to reclamation unless there is reason to suspect that some unusual contamination may be present such as contamination with an acid from a chemical process operation.

CONCLUSIONS

The importance of recycling and disposal of CFCs and halons will increase as virgin CFC supplies disappear. Both on- and off-site recovery and recycling will be used. Many small recovery/recycle devices are being manufactured. Recycle of automotive air conditioner refrigerant is underway, and the major automobile manufacturers have committed to require recycle in their manufacturing plants and dealerships by the fall of 1990. A joint industry/EPA effort similar to that used to facilitate the development of a

realistic automotive air conditioner refrigerant recycle program will be used to expand this program to all other refrigeration and air conditioning applications. The various options that can be used for recovery and recycle of CFCs need to be evaluated so the most environmentally, technically, and economically effective systems can be identified. The number of off-site reclamation facilities is very limited at the present time but several new facilities are scheduled to come on line in the near future. The states have begun to adopt laws that require recycling of CFCs. EPA is currently evaluating the need for a National Recycling Program. EPA has issued a notice that CFCs are not considered as hazardous waste.

Incineration is the only commercially available technology for destruction of CFCs and halons. The environmental concerns surrounding incineration–such as the potentially hazardous products of incomplete combustion and the corrosive acid and/or halogenated gas emissions that may be formed–need to be resolved. A number of other technologies are considered to have potential for destroying CFCs but none of them have been demonstrated commercially for this purpose.

APPENDIX

Off-Site Reclamation Facilities

Appliance Recycling Centers of America, Inc.
654 University Ave.
St. Paul, MN 55104
Phone (612) 291-1100

Appliance Recycling Centers of America has been recovering and recycling refrigerant from disposed domestic refrigerators and room air conditioners since May 1989. They are providing this service at locations in Milwaukee, St. Louis, Atlanta, and St. Paul. Refrigerant from 12 to 14 refrigerators is recovered at one time.

Major Suppliers of CFCs

Most of the major suppliers of CFCs have expressed interest in accepting used CFCs for recycle. DuPont is doing some recycling at a plant in New Jersey and plans to start full scale recycling as soon as state approval is obtained. ICI also is reported to be considering the operation of a recycling facility.[9]

National Refrigerants, Inc.
Hickory Pointe
2250 Hickory Rd.
Plymouth Meeting, PA 19462
Phone (215) 834-020

National Refrigerants has a recovery and reclamation service that includes providing dedicated, returnable cylinders in sizes from 100 lb (45 kg) to 2000 lb (900 kg) capacity containers; trailer transfer capabilities; refrigerant transfer units; reprocessing CFCs to original specifications; waste disposal; and pickup and delivery. They also provide complete analysis of refrigerants.

Omega Recovery Services
12504 East Whittier Blvd.
Whittier, CA 90602
Phone (213) 698-0991

Omega has been reclaiming refrigerants at their facility on the west coast for more than 30 years. They accept 90 lb (41 kg), 145 lb (61 kg), and 1 ton (900 kg) cylinders or truck load quantities. The reclaimed refrigerant is processed to meet new refrigerant specifications. Typical loads handled are 600 to 1000 lb (270 to 455 kg) of refrigerant from commercial or industrial installations. They have worked with systems handling as much as 125,000 lb (57,000 kg). Omega can also provide complete analysis of refrigerants. They plan to build a similar facility on the east coast somewhere between Atlanta, GA, and Charlotte, NC.

Serv-I-Quip, Inc.
127 Wallace Ave.
Downingtown, PA 19335
Phone (215) 873-7010

Serv-I-Quip provides a recovery/reclamation system designed to recover refrigerant from recovery stations located conveniently throughout an OEM plant to remove particles, air, moisture, and acids from the refrigerant to meet new or near new quality. The reclaimed CFC is returned to the supply system—usually to a surge tank until it is analyzed before it is sent to a bulk storage tank. The system has capacities to process 1 to 30 lb/min (0.45 to 14 kg/min) and will handle charges from 100 lb (45 kg) to over 1000 lb (450 kg).

Van Hook Service Company, Inc.
769 Emerson St.
Rochester, NY 14613
Phone (716) 254-4375

Van Hook Service Company is building an off-site recovery and reclamation facility in New York State to process refrigerants from commercial refrigeration and air conditioning systems. Refrigerant will be processed to meet the ARI standard for reclaimed refrigerant.

On-Site Recovery Equipment

A'Gramkow
Augustenborg Landevj 19
DK 6400 Sonderborg
Denmark
Phone +45 4 43 36 36

A'Gramkow has a variety of portable recovery/recycle units and stationary units for production lines that have capacities from 0.2 to 9.2 lb/min (0.08 to 4.2 kg/min). They have a unit that has been certified by Underwriters Laboratories for compliance with SAE-J1991 for recovery of automobile air conditioner refrigerant. A degassing unit to remove residual CFC from used oil is also available.

Applied Ecological Systems
P. O. Box 697
Hazelhurst, GA 31539
Phone (912) 375-3684

Applied Ecological Systems developed the "Retriever" in 1968. It is designed to recover/recycle refrigerants from residential, commercial, industrial, automotive, and transportation applications. Standard units have capacities from 1-1/2 to 3 lb/min (0.7 to 1.4 kg/min). Large systems mounted on a tandem trailer capable of processing 500 to 2000 lb (230 to 900 kg) of refrigerant are available.

Davco Manufacturing Co.
3601 Clover Rd.
Forks Township
Easton, PA 18042
Phone (215) 559-1400

Davco has a portable recovery/recycle device for automotive air conditioning and commercial refrigerant applications.

DRAF Industries Inc.
333 Adams St.
P. O. Box 450
Bedford Hills, NY 10507-0450
Phone (914) 241-2100

DRAF Industries has a portable refrigerant recovery/recycle unit that has been certified by Underwriters Laboratories for compliance with SAE-J1991 for recovery of automobile air conditioner refrigerant.

David C. Grant
% Fentech, Inc.
One Walnut Lane
Selbyville, DE 19975
Phone (302) 436-1780

Grant is developing a recovery/recycle device for refrigeration applications.

High Frequency Products, Inc.
880 N. E. 69th St., Suite 11N
Miami, FL 33138
Phone (305) 899-8309

High Frequency Products has a portable recovery/recycle device in an automotive version and a commercial version. The automotive unit can do simultaneous recovery from multiple vehicles. The commercial unit is modularly expandable by connecting additional receiving vessels.

Industrial Chiller Services
Refrigerant Reclamation Division
4317 FM 2351
Friendswood, TX 77546
Phone (713) 482-9499

Industrial Chiller Services has a large skid mounted recovery/recycle device to do on-site recycle of refrigerant from chillers. The unit weighs about 2400 lb (1090 kg) and is 5 ft (1.5 m) wide, 6 ft (1.8 m) long, and 5 ft (1.5 m) tall. Refrigerant is recycled through the unit until it meets the ARI standard. Storage capacity on-site is up to 21,000 lb (9500 kg) of refrigerant.

Intermark Environmental Sciences, Inc.
110 West Arroyo St.
Reno, NV 89509
Phone 1-800-828-0138

Intermark Environmental Sciences has a portable recovery/recycle device for use on vehicular air conditioning systems and commercial refrigeration and cooling units.

Jameskamm Technologies
P. O. Box 8961
4730 W. Bancroft A-3
Toledo, OH 43615
Phone (419) 531-3313

Jameskamm Technologies has a portable recovery/recycle device for automotive air conditioning and commercial refrigeration applications. It has a recovery capacity of about 2 lb/min (0.9 kg/min).

Murray Corporation
260 Schilling Circle
Cockeysville, MD 21030
Phone (301) 771-0380

Murray has a portable refrigerant recovery/recycle unit that has been certified by Underwriters Laboratories for compliance with SAE-J1991 for recovery of automobile air conditioner refrigerant. They are also making portable units for commercial refrigeration applications.

Recyclene Products, Inc.
405 Eccles Ave, So.
San Francisco, CA 94080
Phone (415) 822-4949

Recyclene Products is developing a recovery/recycle device for refrigeration applications.

Refrigerant Reclaim of Canada
104 Church St.
Weston, Ontario M9N1N5
Phone (416) 242-9746

No information on this company.

Refrigerant Reclamation Systems
P. O. Box 326
Mechanicsville, VA 23111
Phone (804) 746-3231

Refrigerant Reclamation Systems has a portable recovery/recycle device that was originally designed for CFC-11 and -113 but can handle most other refrigerants.

Refrigerant Recovery Systems, Inc.
5021 North Florida Ave.
Tampa, FL 33603
Phone (813) 237-1266

Refrigerant Recovery Systems has recovery/recycle units for use on commercial, residential, and automotive refrigeration and air conditioning systems. As early as 1986, they had units in use at more than 20 municipal transit and large trucking firm garages. The automotive unit has been certified by Underwriters Laboratories for compliance with SAE-J1991.

Robinaire Division
Robinair Way
Montpelier, OH 43543-0193
Phone (419) 485-5561

Robinair has a portable refrigerant recovery/recycle unit that has been certified by Underwriters Laboratories for compliance with SAE-J1991 for recovery of automobile air conditioner refrigerant. The time required to recover refrigerant from a typical automobile air conditioner is about 9 minutes. Robinair also makes portable units for commercial refrigeration applications. The Robinair unit is also being marketed under the following private brand company names:

Kent-Moore
Everco Industries
Bear Automotive
OTC
General Motors

S. G. L. Enterprises
1014 Papaloa
Bastrop, TX 78602
Phone (512) 321-2207

S. G. L. Enterprises has a portable recovery/recycle device for refrigeration applications.

ThermaFlo
3640 Main St.
Springfield, MA 01107
Phone (413) 733-4433

ThermaFlo has a portable recovery/recycle device that can be used for automobiles, buses, trucks, air conditioners, refrigerators, commercial chillers, and virtually any refrigeration system using CFCs. Models are available from 1/4 to 10 hp (0.2 to 7.5 kW). The 1/4 hp (0.2 kW) unit recovers CFC at an average rate of 3 lb/min (1.4 kg/min).

Van Steenburgh Engineering Laboratories
1900 South Quince St., Unit A
Denver, CO 80231
Phone (303) 696-9637

Van Steenburgh Engineering Laboratories has a portable recovery/recycle device for refrigeration applications.

White Industries
9210 Castlegate Dr.
Indianapolis, IN 46256
Phone (317) 849-6830

White Industries has a portable refrigerant recovery/recycle unit that has been certified by Underwriters Laboratories for compliance with SAE-J1991 for recovery of automobile air conditioner refrigerant. Recovery can be completed in less than 10 minutes.

Manufacturers of Centrifugal Chillers

In February 1990, both Carrier and Trane, manufacturers of CFC-11 chillers, announced that they were marketing a refrigerant recovery system for use on centrifugal chillers.

The companies listed below are also marketing a small portable recovery/recycle unit that has been certified by Underwriters Laboratories (UL) for compliance with SAE-J1991 (1989) for recovery of automobile air conditioner refrigerant under a multiple listing. A UL multiple listing is the formal publication of the name of a company that appears on equipment that is UL Listed for another party.

Atlas Supply Company

Four Seasons, Division of
Standard Motor Products, Inc.

Snap On Tools

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